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CHOOSING THE LIVER FUNCTION TEST*

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The fact that the liver has so many functions, as excretory function role in the metabolism of protein and carbohydrates, the detoxifying function by which certain absorbed toxic materials are made innocuous, the hematological aspects of liver function, etc., has led to tests based on these broad functional activities. All workers in the field of liver function have repeatedly warned that no one function of the liver can be taken to indicate the state of the liver as a whole and that the large amount of liver that we have above the actual need is so great that a very large portion of the liver must be destroyed before functional changes can be detected. It has been stated that 95 per cent of the liver must be removed in a dog before jaundice appears. Some functions are disturbed earlier than others and there is no correlation between the type of lesion present and the function which is disturbed nor is there a definite clinical index as to which function is disturbed first.

While the measurement of the degree of bilirubinemia and the VandenBergh test and other tests related to bilirubin metabolism, such as urobilinogen in urine and stool, are perhaps not in the nature

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of pure functional liver tests, nevertheless they give important information in patients with jaundice.

Bilirubin is produced from hemoglobin by the reticulo-endothelial cells and not by the liver parenchymal cells. It is carried to the liver by the blood adsorbed by the blood protein. The parenchyma of the liver acts upon this fixed bilirubin to separate it from the blood protein. Bilirubin, then, that is present in the blood plasma before it has been acted upon by the liver cells and the bilirubin that may appear in the blood plasma after having been acted upon by the liver cells, behaves differently in at least two respects, these differences depending upon whether or not the bilirubin is absorbed to protein or is free. Free bilirubin, posthepatic if I may use the term, is readily filtered by the kidney from the blood and appears in the urine. Fixed bilirubin, even though the patient is visibly jaundiced, does not appear in the urine, or is in the urine only in small quantities.

The VandenBergh reaction on free bilirubin is direct, that is, the reddish violet color appears immediately when the reagents are added to the solution of bilirubin, while if the bilirubin is fixed to the protein of the plasma the reaction is of the indirect type, that is, the color reaction does not take place until after the addition of alcohol to the solution tested. These differences are again due to whether or not the bile is fixed to protein or not. Alcohol when added to fixed bilirubin liberates the bilirubin from protein and makes it free to react with the reagent. Direct reaction, therefore, indicates that the bile has been previously acted upon by the liver cells and the indirect reaction that it has not. There are cases of jaundice in which VandenBergh reaction occur immediately but does not reach its maximum color until some minutes later. This is called the "biphasic reaction". When the reaction of the VandenBergh test is direct, the patient has obstruction to the larger bile channels or diffuse necrosis of liver cells. The indirect reaction indicates increased red cell destruction beyond the capacity of the liver to excrete the bilirubin brought to it, or early liver cell damage, that is, the damaged liver cells cannot excrete the normal amount of bilirubin brought to them. The biphasic reaction indicates both free and fixed bilirubin are present in the blood plasma, pathologically some obstruction to the small bile canaliculi and some liver cell damage. In cases with liver cell damage, such as seen in

certain cases after the use of arsphenamine, etc., it is possible to have an indirect, later followed by biphasic, and still later by a direct VandenBergh reaction, depending upon the degree of liver damage. It is seen that the VandenBergh test is not a test of liver function but that it is used largely in an attempt to differentiate whether jaundice in a given patient is due to obstruction of the ducts to an increased destruction of red cells, so-called hematogenous jaundice, or due to hepatic cell damage. There are other tests that are of some value in this differentiation, such as phosphatase estimation, the amount of phosphatase in the circulating blood rising in obstructive jaundice and remaining normal or less than normal in the presence of liver cell damage; the estimation of cholesterol and cholesterol esters, cholesterol and cholesterol esters rising in obstructive jaundice and diminishing in the presence of liver cell damage with a greater reduction in such cases of cholesterol esters over total cholesterol. Galactose tolerance test is another such test—this will be taken up later.

Bilirubin that is excreted by the liver reaches the intestinal tract where it is changed into urobilinogen by bacteria. Some of this urobilinogen is excreted in the faeces, another portion is absorbed into the portal system, carried to the liver where it is reconverted into bilirubin. In health, only a small amount of the urobilinogen appears in the urine. It is obvious that if bilirubin does not get into the intestinal tract, as in cases of complete obstruction of the common bile duct, no urobilinogen can appear in the urine unless there is infection along the bile passages where bacteria in those positions can also produce urobilinogen just as they can in the intestinal tract. In cases where there is increased blood destruction, as in familial jaundice, there will be an increased production of bile, therefore more bilirubin reaches the intestinal tract and more urobilinogen is formed and there is an increase in the amount of urobilinogen in the urine. If there is a normal amount of urobilinogen produced in the intestinal tract and a normal amount absorbed but the liver cannot reconvert it into bilirubin, the absorbed urobilinogen would be excreted by the kidneys and an increased amount appear in the urine. From the above, an increased urobilinogen output in the urine would indicate damaged liver parenchyma or increased blood destruction. Different investigators vary in their opinions as to the value of this test. It is pointed out that if bile does not reach the

gastro-intestinal tract no urobilinogen can appear in the urine unless there is infection along the biliary tract. There are also cases of hepatic cell damage in which so little bilirubin reaches the intestinal tract that urobilinogen in the urine may be absent. Likewise, there is an increase in urobilinogen in the urine not only when there is mild liver cell damage but also in cases where there is increased blood cell destruction.

The use of materials injected into the blood circulation and the recovery of the material in duodenal content or estimation of the rapidity of the removal of the material from the circulation by the liver has been used as a liver function test for many years. Of the many substances proposed, bromsulphalein, rose bengal, and bilirubin are the most popular. Soffer uses 5mgs. bromsulphalein per kilo body weight and reports that he has never found more than a trace of the dye in the blood at the end of 30 minutes, and considers the presence of 10 per cent or more as definitely abnormal and indicative of liver damage. Magath is also favorable to this dye test. He reports retention of the dye in 96 per cent of cases in which there is evidence of parenchymal hepatic injury or even moderate mechanical obstruction of the bile ducts unassociated with clinical evidence of jaundice. Snell and Magath say that "even a relatively moderate hepatic involvement", in discussing metastatic malignancy of the liver, "will produce a significant degree of bromsulphalein retention". Such a statement to my mind is very laudatory and if true the test would leave little to be desired as a satisfactory liver function test in the absence of jaundice, it being obvious that if the liver cannot free the blood of bilirubin, it cannot be expected to free the blood of an injected dye. Soffer states "in our own laboratory we performed a total of 82 bromsulphalein liver function tests. In a good many instances the evidence of liver disease was confirmed either at operation or necropsy. In the remaining cases the clinical evidence of liver disease is indisputable. Thirty-one of these 82 instances 2 mgs. per kilo body weight of the dye were employed, seven or 22.5 per cent only showed abnormal results. Of the 52 cases where 5 mgs. per kilo of the dye were employed 32 were positive, or 61.6 per cent". Therefore, note that when using small amount of the dye 2 mgs. per kilo only 22.5 per cent of the cases in which there was disputable evidence of liver disease showed positive results, while when 5 mgs. per kilo body weight were used 61.6 per cent was

positive. The greatest incidence of positive results were obtained in cases of portal cirrhosis with ascites. "In malignancy of the liver, either primary or metastatic, increased retention of dye is considerably less."

What is said of bromsulphalein also applies to rose bengal or the use of bilirubin as a liver function test. The main objection to bilirubin is its cost and the fact that deductions are drawn on slight differences in the amount of bilirubin in the blood serum at the beginning and at the end of the test, it being questionable if the degree of accuracy in estimation of serum bilirubin is such as to permit broad deductions being drawn on such slight differences. Soffer reports a higher percentage of positive results using bilirubin than from the use of bromsulphalein in cases with hepatic damage.

The utilization of sugar as a test for hepatic function is based on the fact that sugar is converted by the liver into glycogen. Theoretically, if the liver is damaged, carbohydrate cannot so readily be converted into glycogen; therefore, there should be a rise of blood sugar or the appearance of sugar in the urine. It has been observed that when levulose or galactose have been used in normals there is no significant hyperglycemia or glycosuria.

In the levulose tolerance test 40 gms. of levulose are given in 200 cc. lemonade and blood sugars determined one and two hours later. An increase of 30 mgs. per cent indicates a positive result.

The galactose tolerance test is based on the observation that a normal person can ingest 40 gms. of galactose without losing more than 2.5 to 3 gms. of the galactose in the urine within the next 5 hours. In the presence of hepatic injury the conversion of the ingested sugar into glycogen fails and the person tested excretes more than the normal 2.5 to 3 gms. Soffer regards the carbohydrate tolerance test inferior to bromsulphalein or bilirubin excretion tests. In general, he thinks the levulose tolerance test superior to the galactose tolerance test, but the levulose tolerance test is less liked by patients. Snell and Magath say in regard to the levulose tolerance test "in general, however, the field of usefulness of this test is limited" and of the galactose tolerance test, "so far as we have been able to determine, the test has no value whatever in cases in which patients are not visibly jaundiced".

In speaking of the differential diagnosis of the different types of jaundice it was mentioned that the galactose tolerance test was sometimes used in such differentiation. Where there is liver cell damage, galactose is not so readily converted into glycogen and more will appear in the urine. In obstructive jaundice, without liver cell damage, only normal amounts appear in the urine. Soffer, for example states "the chief usefulness of galactose tolerance test is in the differentiation between obstructive and non-obstructive jaundice".

Numerous substances such as thymol, menthol, camphor, cincophen, benzoic acid, etc., have been used to test the detoxifying function of the liver. Perhaps the best of these is the benzoic acid test. It depends upon the ability of the liver to form hippuric acid from benzoic acid by the addition of amino acetic acid. This test at present is receiving a large amount of attention. Most authors are reporting very satisfactory results. Snell and Magath state the results with this test parallel those with the bromsulphalein. It can be used in patients with jaundice which is an advantage. Low rates of hippuric acid in urine with this test bespeak poor surgical risk. However, in the presence of low hippuric acid output one should be sure that the results are not due to poor absorption of the ingested benzoic acid or due to the renal factor, such as dehydration or other causes for water retention.

The estimation of prothrombin is not strictly a liver function test, yet we know that when the liver parenchyma is damaged bleeding is likely to occur and the greater the degree of liver cell damage the greater the danger from hemorrhage. Prothrombin tests at present are used pre-operatively in cases of jaundice. It gives the surgeon an excellent idea of whether the patient is likely to bleed from any operative procedure.

In conclusion, then, in choosing the liver function test, it should be pointed out that none are infallible or universally applicable. In the presence of jaundice, the differentiation of whether it is obstructive, hepatic, or due to increased red blood cell destruction, help can be obtained by the galactose test, the urobilinogen in the urine, the serum phosphatase, and cholesterol-cholesterol esters. Here, too, the VandenBergh test is of some value. In the type of disease of the

liver not associated with jaundice, information can be obtained by the study of the excretion tests, such as bilirubin excretion test and the bromsulphalein test. The hippuric acid test is useful in both jaundice and non-jaundice type of liver disease.

A RAPID AND ACCURATE METHOD FOR THE DETERMINATION OF UREA IN BLOOD

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The technique given here has many advantages over previous methods. The principles upon which most methods for the determination of urea nitrogen in blood are based are either hydrolysis of urea by the enzyme, urease, or by heating under pressure, thus eliminating the use of urease. After urea has been converted into ammonium carbonate, various means are used to determine the nitrogen content. The ammonia is either distilled off or aerated into an acid medium after which the ammonia content is determined either by Nesslerization or by titration. Either of these methods has the disadvantage of being time consuming and cumbersome, especially in routine work where many determinations are made daily.

In attempting to devise a simpler, more accurate and more rapid method a modification of Karr's technique of direct Nesslerization in the presence of gum ghatti was resorted to. In following the original Karr technique it was found that when Nessler's solution is added directly to the hydrolized filtrate, precipitation, and often diminution of color occurs, which renders matching in the colorimeter inaccurate. It has been thought that if gum ghatti or a similar "protective colloid" is added to the filtrate directly before Nesslerization, precipitation would be delayed until comparison could be made. Experience in this laboratory has shown, however, that the results are extremely inaccurate and that there is no uniformity in error. It has finally been demonstrated that the "interfering substances", whatever they are, may be overcome by omitting the gum ghatti and the sodium acetate buffer and by adjusting the ⅔N sulphuric acid reagent which is used in the preparation of the protein-free filtrate, so that filtrate has a pH of 4.4—4.6. The ⅔N sulphuric acid with 10 per cent Sodium Tungstate ordinarily produces a blood filtrate with pH of about 3.5. This acid solution may be diluted with distilled water until the resulting filtrate is well within

the pH range given above, without any danger of incomplete protein precipitation.

The test, as modified, is performed as follows:

Reagents

(a) Urease paper: The method of preparation given by Folin is satisfactory (Lab. Methods, U. S. Army, 4th Ed., P. 322).

(b) Nessler Solution: The same as used in the determination of N.P.N.

(c) Standard: The same as used in the determination of N.P.N.

Technique

Transfer 5 c.c. of protein free filtrate (which should have a pH of 4.4 to 4.6) into a 25 c.c. graduated, glass stoppered, mixing cylinder which has been thoroughly cleaned with Nitric acid and rinsed several times with distilled water. The final rinsing should be neutral to litmus. Into a similar graduated cylinder put 0.75 c.c. of the standard and 4 c.c. water. Then into each cylinder put one square (½ in.) of urease paper. Digest at room temperature for thirty minutes. Shake frequently during digestion. Add water up to 20 c.c. and finally add 2 c.c. Nessler's solution to both Standard and Unknown. Stopper, invert and compare in colorimeter.

Calculation

The unknown may be set on the left side at 15 mm. The reading of the standard when matched, gives directly the Urea N. per 100 c.c. of blood, if 5 c.c. of filtrate are used.

$$\frac{\text{Standard}}{\text{Unknown}} \times .075 \times \frac{100}{0.5} = \text{mg. urea N per 100 c.c. blood.}$$

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THE USEFULNESS AND RESPONSIBILITIES OF MEDICAL TECHNOLOGISTS IN THE PRACTICE OF ROUTINE HEMATOLOGY*

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Throughout the ages blood has held a dominant place in the mind of man. The fact that more than a dozen new texts and editions have appeared on blood disorders since 1935 shows the current interest in the blood. During the past two decades, the increased demand for applied hematology as an art and a science has attracted many individuals with aptitude and training in the basic sciences.

In the practice of present day hematology, the usefulness of Medical Technologists is directly proportional to their training, and to their ability to utilize time-saving technology. In as much as the value of routine hematology is dependent upon the dispatch of reports to physicians, it is essential that a simple uniform "routine" be used.

This discussion is based upon the fact that a blood count and syphilis tests are routine procedures, and the fact that oxalated venous blood is practical[1] for all routine because it enhances the possibilities for a correct hematologic diagnosis and reduces the number of skin punctures on a patient. When new or well-sharpened needles are used, a venipuncture is not as painful as a two to three (2-3) millimeter deep finger puncture. Even on the obese and children, it is exceptional that venipuncture proves impractical.[1]

When oxalated venous blood is used for routine and special hematology, certain precautions should be used for optimum results:

1. *The syringe and needle* must be dry, otherwise hemolysis is likely to occur. Rinsing a syringe with saline is apt to cause an

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appreciable dilution error; therefore, it is recommended that a sufficient number of syringes be on hand to allow a dry syringe and needle for each collection. After use, air should be drawn to at least seventy-five (75%) per cent of the capacity of the syringe to prevent "sticking". If syringes are well-washed in tap water and placed into distilled water for several hours to remove traces of fibrin, "sticking" rarely occurs.[2] Sterilization is optional.

2. *The size of the needle* is important; it should be large enough to allow a rapid flow of blood into a syringe. For routine work twenty gauge (20 G) one (1) inch needles are practical.

3. *Stasis* must be avoided or counts will be too high.[3] If a tourniquet is used, it should be released as soon as a needle enters a vein.

4. *Collection* should not exceed ninety to one hundred and twenty (90-120) seconds.[1, 4] A longer time may result in coagulation of the blood starting within a syringe when a clotting time is rapid.

5. *A definite amount of oxalate* must be used.[1, 5] Potassium oxalate is used generally in the proportion of two (2) milligrams per cubic centimeter of blood because it is more soluble than the sodium salt. "Oxalate" tubes should be cautiously prepared. Van Slyke[6] warns against heat in evaporation to dryness, since the oxalate radical breaks down into alkaline carbonate when these compounds are heated.

Evaporation to dryness can be accomplished by:[7]

1. Placing the tubes on top of a hot air sterilizer.

2. Placing the tubes in the 56°C water bath.

3. Placing tubes 6 inches above radiator in the winter.

Inasmuch as ammonium oxalate eliminates all nitrogen determinations, its use is not recommended for routine hematology. Magath[5] has written an excellent review upon anti-coagulants.

6. *Satisfactory blood smears* can be made from venous blood if films are made immediately after the needle is taken out of a vein —from the needle tip. Dr. Nelson[7] has a simple and practical

method for making smears from venous blood. His technic is essentially that of Daniels[8], except, as soon as the blood runs out along the line of contact, lift the spreader slide *up*, and *out* of the drop, and then make a new contact before advancing the spreader slide to the other end. The blood adhering to the spreader slide is usually the right amount to make a good film. This technic holds whether one or many drops emerge from a needle tip. Two or more smears should always be made so that special stains may be done if the routine stain indicates their advantage. Smears should always be labeled with the patient's name before leaving a room.

7. *A portion of blood* should be placed into the "oxalate" tube and oxalated before clotting begins, and the rest into the serology tube.

8. *All tubes* should be adequately labeled before leaving a patient's room. Too much stress can not be laid upon this responsibility of Medical Technologists.

The methods chosen for routine hematology should be selected for their scientific merits, simplicity, and accuracy, as it is imperative that the various measurements made upon blood be well within the limits of clinical accuracy. In the checking of ordinary hematologic apparatus, the following simple methods are of value:[2]

Hemoglobinometers are checked by methods given by Stitt.[8]

Faulty Pipettes are weeded out by either doing a series of counts on the same blood, or checking the hemoglobin dilution in a Haden colorimeter[14]; colorimetry is more accurate than a scattergram. A good discussion on the calibration of pipettes is that of Dunn.[9]

Counting chambers are checked by comparative counts on a second chamber. It is expedient to have a reserve chamber in case of breakage.

Hemacytometer cover-slips are checked for warping and uniform thickness by recounting another sample of the same blood by turning the slip over and comparing with counts done with an acceptable slip.

Hematocrit tubes are checked by doing multiple estimations upon the same blood. In measuring blood into narrow hematocrit tubes, particular attention must be paid to manipulation because, with

rapid sedimentation, it is difficult to withdraw volumes with equal numbers of blood cells.

The demand for readily available reports established this routine: all blood collections are made as early as possible and then the procedures are started.

1. *Smears are stained* with Feemster's modification of Wright's.[10] In hot arid climates Wright's method is not as reliable as the Feemster modification.

2. *Cell dilutions are made.* Freshly filtered Toisson's solution is used as the diluent for erythrocytes since it is likewise satisfactory for thrombocytes.[11] The critical review of Tocantins[12] is recommended for more technical methods and a review of the literature on thrombocytes. Attention is called to Dameshek's method[13] for thrombocytes since it permits a thrombocyte and reticulocyte count with the same preparation.

Tenth (1/10th) normal hydrochloric acid[14] is used as the diluent for leukocytes since a Haden-Hausser[15] hemoglobin estimation can be done directly from the white cell pipette. Other methods for hemoglobin estimations may be more advantageous, but the simplicity and close accuracy of this method led to its adoption for routine work.

3. *Smears* are destained, washed, and dried.

4. *Total counts are made.* The hemoglobin estimation is done from the white cell pipette after the counting chamber has been filled.

5. *Differential counts* are done last.

A simple time-saving measure for recording hematologic data is this: all original figures are placed upon the back of the laboratory record card, including the differential tally—thus it should be evident that errors may be caught if such a method is used for recording the actual tests.

When special hematology is ordered, it can be woven into the routine before the total counts are begun without much delay in the routine work. The use of oxalated blood for all routine saves much laboratory time since the original sample may be used for many special tests.[1]

Venous blood is preferable for clotting mechanism tests.[1] The Lee and White Method for coagulation is the one of choice. The use of venous blood for routine hematology lends itself to the new rapid bedside method of Ziffern, Owen, Hoffman, and Smith[16] for prothrombin.

Wintrobe[17] has pointed out that potassium oxalate does not depress the rate of settling of red cells in plasma. A slow, rapid, or a fast sedimentation may be noted by observing the rate of settling of red cells in the oxalate tube and may be recorded as a 1, 2, 3, or a 4 rapidity.[7]

Van den Bergh and Icterus index studies may be done with oxalated plasma.[1]

When blood grouping is a routine procedure, typing with oxalated cells and plasma is a real time-saver.[18, 19] The writer has typed over one thousand (1000) in triplicate using, serum and cells, plasma and cells from defibrinated blood, and the plasma and cells from oxalated blood.[4] In this series no group variations were noted; the reactions were clear cut with oxalated blood, and in some instances preferable.

Reticulocytes may be done by any of the usual methods. The Osgood and Wilhelm[20] technic gives excellent results and is recommended for oxalated blood. Nittis[21] and Isaacs[22] have pointed out that the reticulum in immature erythrocytes is a precipitate caused by the interaction between a basophilic substance and a vital dye. In the wet state this reticulum may be stained with any number of basophilic dyes. One per cent (1%) methylene blue in physiological salt solution (0.85% NaCl) has given results[4] comparable to the Osgood-Wilhelm technic in the writer's hands.

In fragility studies, the Giffen and Sanford[23] technic is widely used. When a fragility test is done at the bedside with venous blood as recommended by Kracke[24], one should take the precaution to have *a very smooth working syringe* so that single "dropping" can be controlled.

Davidsohn's technic[25] for heterophile antibodies is simple and practical. His method for absorbing interfering antibodies with antigens easy to prepare and to preserve, is a real contribution to Medical Technology that warrants usage.

In the use of hematocrits, the question should come up of what correction factor to use. Wintrobe[26] gives three and seven-tenths per cent (3.7%) shrinkage when two milligrams of potassium oxalate are used per cubic centimeter of blood. There are two different reports on this: the one is Haden[27], the other is Boyd[28]. In both, definite ratios of oxalate are involved. Whereas in 1930 Haden[27] reviewed the inconsistencies of various workers, apparently no hematologist applied the physical chemistry that Boyd has for obtaining constant cell volumes. He takes the amount of oxalate, the time of exposure to oxalate, and centrifuging to translucency of the entire sample, as criteria for erythrocyte volume studies. In routine work one may not have precise oxalate blood ratios, but, if such happens, there is no way of giving a correction factor.

Some writers prefer Wintrobe's[29] newer measurements based upon the actual cell volume, red cell count, and grams of hemoglobin to indices such as volume index, saturation index, and the like which are based upon arbitrary numbers.

Although a Rumple-Leeds test is not required of Medical Technologists, a positive may be noticed at the time of venipuncture and, if detected, this should be reported.

The importance of routine hematology and the usefulness and responsibilities of Medical Technologists are illustrated by the following cases:

Case 1:

The laboratory findings on a case diagnosed pernicious anemia were: hemoglobin 6 grams; erythrocytes 3½ millions; mean corpuscular volume 58. The attending physician disputed the report. The original blood sample had been kept; repeat blood counts were done on the original and a second sample, and found to be in close check. These rechecks could not have been done if oxalated blood had not been used, nor could the pathologist have corrected this mistaken diagnosis if capillary blood had been used for the routine.

Case 2:

A traveling salesman was admitted for palliative treatment of sore throat; the routine blood collection was made just before the patient left the hospital. The blood smear showed a few mononuclears suggestive of mononucleosis. Davidsohn's tests for hetero-

phile antibodies were done and found to be positive in the latent zone. The diagnosis in this case would have been missed if a routine examination had not been done, and delayed if oxalated venous blood had not been on hand, for the patient was gone. This case shows the value of doing the Davidsohn tests electively on any blood showing atypical mononuclears.

Case 3:

This case was first seen by a fellow technician in the Nelson Laboratories. A middle age man had a tooth pulled; a severe hemorrhage followed which necessitated an emergency transfusion. When the cross-matching tests were examined microscopically, many large cells were seen. A blood smear was made from cells not caught in the clot—*myeloblasts* were found. This case proved a typical leukemia.

The practice of hematology as an art and a science carries with it a grave responsibility, for a correct hematological diagnosis can not be made unless a worker has the ability to apply special hematology when it is indicated, and to recognize abnormal cells in a stained smear. In various texts and atlases, definite rules have been laid down for cell identification based upon nuclear structure, the character of the cytoplasm, and the presence or absence of granules. It is the responsibility of every Medical Technologist to know hematologic classifications and nomenclatures. Furthermore, technologists should be keenly aware of any cell which they can NOT classify.

It has been the good fortune of the writer to study hematology with Dr. Kracke. A major portion of his course is devoted to the identification of various blood cells from selected dyscrasias and "unknowns". The value of the detailed work which Dr. Kracke, of Emory University, requires in the study of stained smears can not be over-estimated.

In the 1936 *Hematological Review* of Dameshek[30] technicians were openly rebuked: He wrote, "What strikes the reviewer in seeing these cases (leukemia) is the blind faith so often placed by physicians in the reports of technicians. This illustrates again the power of the written word, particularly on a laboratory report. With few exceptions technicians seem to call all types of cells with deep blue cytoplasm 'lymphocytes', or large 'mononuclears' whether

they are lymphoblasts, myeloblasts, or histiocytes".

As a Medical Technologist limited to the practice of hematology, it does not seem possible to overstress the importance of the application of the principles of basic sciences to quantitative procedures, and the continual study of erythrocytes, leukocytes, and thrombocytes.

The writer acknowledges her indebtedness to Dr. I. A. Nelson, A.S.C.P., Tulsa, Oklahoma, for many suggestions pertaining to the practice of Hematology as a *science*.

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THE VALUE OF PHOTOGRAPHY IN TECHNICAL WORK

By VIOLET PAYNE, M.T.

Lincoln, Nebraska

Photography is a field which is very much neglected in the work of the Medical Technologist, and yet I believe it is an important part of a Technologist's accomplishments. The need for photography is as important in a doctor's office as it is in a large hospital laboratory.

A Technologist who knows photography can be a great deal of assistance to her employer. Doctors could use more of photography but do not have the time to do it themselves, or are not skillful in it. If the doctor had someone who could do these things for him he would probably find many uses for photography in his practice.

There are so many uses for photography in an office or a hospital laboratory that I will only mention the important ones here. In a patient's chart, a photograph of tumors, ulcers, skin lesions, abdominal ptosis, would save several pages of descriptive writing, and thereby save a great deal of the doctor's time. A photograph would also tell the story of the case much better than a long description. Pictures could be taken of overweight patients or a patient with hypothyroidism or skin lesions showing how they looked before and after treatment. In the hospital there is an endless number of things for which photography is needed. Photographs of gross pathological specimens, microscopic sections, lantern-slides for display and etc.

Photography is useful for copying; for instance tables, charts or pictures may be photographed out of books or journals and filed in your laboratory notebook. Or you may want to copy an entire article out of a journal and put on file, where it would be easy to get at. Another common use for photography is making small-size copies of X-Ray films or electrocardiograms, either to file in charts or to send out of the office, thus preserving the original intact.

One of the most important phases of clinical photography is photomicrography. The doctor may have special types of blood cells which he wants pictures of. He often wants photographs of microscopic sections, or lantern slides made for use when giving addresses, or for demonstrating purposes, or for articles he is publishing. He may even appreciate these in direct natural colors, which modern technic makes possible.

If you have never done any photographic work you will probably think that it is an expensive project to start, and that complicated and expensive apparatus is necessary. As a matter of fact the beginning in photography can be very simple. You do not need a highly advertised prohibitively expensive miniature outfit to get good results. Some very fine work in photography is done with inexpensive cameras. All of the books and magazines on photography give simple working methods. A very good book is *"Principles and Practice by C. B. Neblette"* Another fine book for beginners is the *"United States Government Manual"* put out by the War Department for sixty-five cents which covers photography very thoroughly.

The first thing to learn in photography is how to use your camera. You have to get used to using your camera just as you learn how to use any other piece of apparatus. Do not begin to take pictures until you have become familiar with the shutter, different diaphragm openings, focusing methods, the way to open and shut a camera. After you have become familiar with the camera the next thing to learn about is the different types of films. There are really only three types of films, but they have a variety of trade-names:

1. Color blind film (sensitive chiefly to blue).
2. Orthochromatic (sensitive to yellow).
3. Panchromatic (sensitive to red).

One of the hardest and most difficult problems in photography is correct exposure. This is a problem every individual must work out for himself. Proper exposure depends upon the amount of light, the type of lens in the camera, and the subject which you are taking. If you are a beginner the best way of doing this is to keep a notebook with a record of the different subjects you have taken, the type of film used, the exposure given to each subject. Then

the next time you want to take a picture you can refer to the notebook and have a fairly good idea of how to take your picture.

Half of the fun as well as the value in photography is in developing and printing your own pictures. Anyone can take pictures to the corner drug store for development, but no commercial finisher can do your work satisfactorily for scientific purposes. If you will give your negative the proper exposure and then develop by time, it will save a great deal of extra work. You can purchase developer and hypo from any photographic store, but it is very inexpensive and simple to make up.

Beside being of value in your technical work, photography has a personal value to you as a hobby. Photography is the best means in existence of acquiring general culture. It teaches you to observe the world around you. It gives you an insight into physics and chemistry and the principles of creative art. There is no end to photography once you start it. No matter how much you achieve there is always more ahead.

CHARTS AND FILES IN THE PATHOLOGICAL LABORATORY*

By PHYLLIS STANLEY, M.A., M.T.

Presbyterian Hospital, Newark, New Jersey

The purpose of a filing system is to keep material in an orderly arrangement so that at a later date one can find, at short notice, the data required. A charting and filing system is not born over night. Unless a new Hospital copies in detail the set up of some well established, similar type of institution, the entire system is one of evolution and inheritance. The small hospital is the one in which I am most interested. Large hospitals associated with medical schools present a slightly different problem, as any data collected may be used in a research problem or for teaching purposes. Usually such institutions have more clerical help or students and interns to collect the data and prepare it as needed, under the supervision of a doctor who is particularly interested in the special problem under investigation.

I am presenting a plan applicable to the small hospital laboratory having one or more technologists and a pathologist. If the institution is small enough to have only one technologist the volume of work is small enough for her to properly keep the records. As the amount of work increases the staff increases, so that we find in the larger hospitals three or more technologists and one or two clerks to keep the records.

The system I am outlining was evolved at the Presbyterian Hos-

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* *Read before the Seventh Convention of the American Society of Medical Technologists, St. Louis, Mo., May 19,1939.*

pital in Newark over a period of 15 years. The system of keeping charts and files must be one of evolution, a slow but ever growing method, changing to keep up with the times. The scope of laboratory work is expanding and increasing and the recording system must expand if it is to be efficient.

The main purpose in doing any laboratory examination is to find the condition of the patient on a certain day and record it in such a way that any one at any time may be able to refer to the report and understand it.

There are certain reports which the laboratory is expected to keep and be able to find on short notice. These include reports of serological examinations, basal metabolic rates, surgical pathology and autopsies. The laboratory should also keep on file, for easy reference, tissue slides, prepared museum specimens, photographs, lantern slides and negatives of all photography work as well as hematological and bacteriological smears.

Clinical laboratory work may be divided into four phases. The first includes receiving a request for the examination to be done, and obtaining a satisfactory specimen in the proper condition accompanied by any data necessary for the intelligent examination of the specimen in question. The second part is doing the laboratory examination in an efficient and exact way. The third is preparing a report in as concise a way as possible so that not only the doctor who ordered it may have it but so that anyone referring to it in the future may be able to find and understand it. The fourth is keeping a record of the material which has been preserved so that it may be found when needed.

We have two types of request slips for clinical pathology.

No. 2

THE PRESBYTERIAN HOSPITAL

REQUEST FOR LABORATORY EXAMINATION

Specimen to Be Taken by Nurse or Interne

Name_____ Room_____ Date_____

Doctor_____ Nurse_____

Emergency Time of operation

URINE	BACTERIOLOGY	FECES
Aschheim Zondek	Smear or	Routine
Bile Salts	Culture	Blood
Urobilinogen	from_____	Typhoid
Urobilin	for_____	Parasites
Sugar (Quantitative)	Diphtheria	GASTRIC ANALYSIS
Chlorides (24 hr. Spec.)	Gonococcus	Routine
Urea (24 hr. Spec.)	Other Organisms	Blood
Cystoscopic Spec.	T.B.	Spinal Fliud
Culture (Cath. Spec.)	Vincents Angina	Routine
T.B. (Cath. Spec.)	Animal Inocculation	Culture
Phenol Red Test	Autogenous Vaccine	Wassermann
Mosenthal Test	Pneumococcus Typing	Colloidal Gold

MISCELLANEOUS_____

REMARKS_____

It is a standing rule that every specimen brought to the Laboratory shall have a yellow slip attached.

No. 1

THE PRESBYTERIAN HOSPITAL
REQUEST FOR LABORATORY EXAMINATION
Specimen to Be Taken by Laboratory

Name_____ Room_____ Date_____

Doctor_____ Nurse_____

Emergency Time of operation

BLOOD EXAMINATIONS

Complete Count	Complete Chemistry	Type
Hemoglobin	Creatinine	Direct Test
Leucocytes	Sugar	Culture
Erythrocytes	Urea	Fragility Test
Differential	Uric acid	Sedimentation Time
Schilling index	Chlorides	Wassermann
Bleeding time	Calcium	Kahn
Coagulation time	Carbon Dioxide	
Platelet Count	Cholesterol	Metabolism
Malaria	Icterus Index	
Stippling	VandenBergh	Miscellaneous_____
Agglutination for	Phosphorus	_____
Typhoid	Non Protein Nitrogen	_____
Para typhoid A & B	Total Protein	_____
Brucellosis	Cell volume	_____
Typhus	Sulfanilamide	_____

REMARKS_____

The nurse brings this slip to the Laboratory as soon as the Doctor has written the order on the chart.

The technologist makes out a white miscellaneous slip and puts the yellow slip on the so-called "charge spindle". When the technologist returns with the blood specimens she makes out a laboratory slip and puts the blue request slip on the charge spindle. Numbers are assigned to the various laboratory procedures, to facilitate the recording on the daily report and charge sheets. This is how the cashier charges each patient for the laboratory work done. This relieves the laboratory of all responsibility of the cost of tests and does away with arguments and requests for reduced rates.

Routine urine reports are recorded on small yellow slips with captions similar to those on the large yellow slip put on the chart.

Routine urine specimens are sent to the laboratory in a tube with a buff tag, and pre-operative specimens have a red tag bearing the patient's name, room number, date and time of operation. We can tell at a glance which specimens should receive prior attention. A carbon copy is made of the report of pre-operative urine analyses and sent to the operating room as early as possible, to avoid delaying the operation.

The pink blood, yellow urine, and white miscellaneous slips are taken by the Secretary to each section and copied onto the patient's chart, in ink. The various slips are brought back to the laboratory and filed in a basket by subject for easy reference until the first of each month when they are added up for the monthly report.

The chart of the patient may carry six slips for which the laboratory is responsible. Thin, regulation 9 x 11 paper is used. In the course of a year the thickness of the paper makes an appreciable difference in the amount of space required to file charts. There is the yellow slip with spaces for 6 urine analyses, blood counts and Wassermanns with captions as follows:

PRESBYTERIAN HOSPITAL

Name_____Room_____

URINE EXAMINATIONS

Catheterized
Quantity
Color
Transparency
Reaction
Specific Gravity
Albumen
Glucose
Acetone
Diacetic Acid
Urea
Chlorides
Indican
Bile Pigment
Urobilinogen
Urobilin
Casts: Cellular
" Hyaline
" Granular
Leucocytes (No. H.P.F.)
Erythrocytes (No. H.P.F.)
Epithelial cells
Mucus Shreds
Crystals
Amorphous Sediment

BLOOD EXAMINATIONS

Hemoglobin
Erythrocytes
Achromia
Anisocytosis
Macrocytes
Poikilocytosis
Polychromatophilia
Stippling
Normoblasts
Megaloblasts
Reticulocytes
Color Index
Leucocytes
Neutrophiles
Band Forms
Segmented Forms
Eosinophiles
Basophiles
Lymphocytes
Monocytes
Myeloblasts
Myelocytes, kind
Lymphoblasts
Toxic Granulation
Shift to Left
Platelets
Malarial Organisms—Parasites
Coagulation Time
Bleeding time, free
Bleeding time, under pressure
Clot Retraction
Wassermann Reaction
Kahn Precipitation Test

The second is the yellow slip which carries all miscellaneous reports. This is just a plain yellow sheet bearing the patient's name and room number and columns for the date, specimen and report.

The third is the printed chart with the graph of the Sedimentation rate as suggested by Cutler.

The fourth is the transfusion sheet, arranged as follow:

THE PRESBYTERIAN HOSPITAL

TRANSFUSION SHEET

Name_____

Date_____ Room_____ Service_____

I do hereby grant the Medical Staff of the Presbyterian Hospital permission to give a blood transfusion to the above named person, using_____ as a donor. I relieve the Hospital and Medical Staff of any responsibility in case either the donor or the recipient should be found to be diseased.

Witness_____ Signed (Patient)_____

Signed (Donor)_____

Date of transfusion_____ Time_____ No._____

Number of cubic centimeters given_____

Nurse in charge_____

Instrument nurse_____

Surgeon_____

Assistant Surgeon_____

Type Patient (Jansky)_____ (International)_____

Type Donor (Jansky)_____ (International)_____

Cross matching_____ Done by_____

Serological test_____

_____

Signature of operator

The operating room uses the lower half of the page to fill in the necessary data and thus saves one sheet on the chart.

Five is the blue tissue report sheet. This carries in detail a description of the gross specimen, microscopic findings, diagnosis and signature of the pathologist. Two carbon copies are made of this, one sent to the doctor, the other kept on file in the laboratory. These sheets are kept by number in looseleaf file books. The sixth is the autopsy report sheet which carries a detailed report of the gross and microscopic findings and anatomical and histological diagnoses. Two copies are made, one being put on the patient's chart and the other kept in the laboratory in a looseleaf file.

Other files are necessary so that data may be found easily. All hematological and bacteriological smears are kept by number in the boxes in which the slides come, and filed away each month.

Surgical pathological specimens are brought to the laboratory by the operating room orderly. Each specimen is placed in formalin in a covered jar, with a gummed label bearing the date, name, age and room of the patient and the organ removed. The nurse in charge of the room where the operation was performed makes out a blue slip bearing this information and in addition the name of the surgeon, the clinical diagnosis and any other useful data she may obtain from the history, chart or surgeon. Each specimen is given a serial number. A plain white slip is attached to the blue one sent from the operating room. The Pathologist dictates the gross description which is written on the attached white slip.

When the slides are stained, the number is written on the slide in black glass marking ink. After the Pathologist looks at the slides and discards the extra and unimportant ones, the others are ready for labeling for the permanent file. We use the so-called Paragon system for labeling our slides. This is very simple; a cardboard label is placed on one end of the slide and a very narrow one is placed on the other end. The cardboard is just a little thicker than the cover slip. The slides are filed away, packed side by side one behind the other. There are numerous slide cabinets on the market. Some take up a lot of space and some are expensive. We bought a very cheap, 27 drawer filing cabinet, had wooden racks built and now file 4 rows of slides in each drawer. No space is lost and the

entire cabinet is a very compact unit. We keep a cross file of the pathological reports. One card carries the name, date, number and diagnosis. This is filed alphabetically so we can find the report of a patient easily. The other carries the Pathological diagnosis arranged according to the numbers as compiled by the National Conference on Nomenclature of disease. This is useful when looking up data of pathological diagnoses for reports and statistical studies.

The lantern slides are kept in drawers and filed by number. The number is the serial number of the negative given to it as made. Routinely all photographs are taken on 5 x 7 negatives. Each negative is placed in a white folder and given the negative number, the number of the tissue specimen, the diagnosis, and the microscopic description as it appears on mounted photographs. The negatives are filed away in the boxes they come in. A cross index is kept. One file is arranged by pathological number so it is easy to see whether or not there are any photographs of a given specimen. The other file is arranged by organs so one can readily find all the photographs of a particular organ, as: the spleen, liver, lungs, etc.

We also keep a file of all the prepared museum specimens. The card for this file carries the number, diagnosis, age and sex of patient and any other data which appears on the jar label. The number of the museum case and shelf where the specimen is kept is also written on the card. The cards are filed by specimen number so it is easy to check whether or not a specimen has been preserved as a museum specimen.

All this description may sound like a very complicated system. I assure you that it is not. The time saved when it is necessary to look up some data is well worth the time spent in entering the different items in the correct file.

RYTZ TEST

By HENRY G. HADLEY, M.D.

1252 Sixth St., S. W., Washington, D. C.

This method consisting of two tests, Rytz Antigen I* and Test II,** was introduced by Rytz in March, 1935. The unusual feature of the test is that it makes use of ammonium sulphate in ⅛ saturation of the total mixture of the serum and ammonium sulphate.

The test No. I requires a mechanical shaker and several inversions of each tube. The method of Test No. II uses a different antigen and uses the precipitate after centrifuging and discarding the supernatant fluid. This precipitate is shaken with 1 cc. of physiological salt solution before reading. Spinal fluids are run with the antigen in II using 2 cc. of spinal fluid instead of the 0.15 cc. of the blood serum.

Three hundred tests were performed in comparison using both methods No. I and No. II, with the Kline, Laughlen, Hinton and Eagle tests. All of the strongly positive sera reacted with both the No. I and No. II antigens. The weakly positive sera especially in treated cases were somewhat more difficult to interpret than the Kline and Laughlen tests and approximately the same as the Eagle.

The time consumed in performing the test was somewhat greater than in most other flocculation tests and while it is reasonably accurate it appeared slightly less sensitive than the Hinton, Kline or Laughlen. Any one flocculation method does not give complete satisfaction and it would appear easier to use a combination of two or

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* 15 cc. serum, heat 60°C. for three minutes, cool slightly, add 105 cc. half saturated ammonium sulphate, shake few seconds, add 0.05 cc. emulsion, mix by shaking, add 1 cc. of 0.9% NaCl, shake vigorously, then place in a mechanical shaker for three minutes, add 2 cc. 0.9% NaCl and invert slowly three times.

** 0.15 cc. serum or 0.2 cc. citrated plasma, add 0.05 cc. half saturated ammonium sulphate, mix by shaking a few seconds, add 0.05 cc. antigen, shake to mix, centrifuge three minutes at 2000 r.p.m., add 3 cc. distilled water, and invert twice to mix.

more of the other methods such as the Kline, Hinton and Laughlen, which do not require so many steps.

Conclusions

In these 300 tests, the Rytz gave satisfactory results with sera which was strongly positive giving no false negatives. It, however, requires more time in performance and is not quite as sensitive as the other flocculation tests mentioned.

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Rytz, F. Rapid flocculation method for diagnosis of syphilis; technic for spinal fluid. J. Lab. and Clin. Med., Oct., 1936, 22:82-83.

ABSTRACTS

OBSERVATIONS ON THE ADRENALIN LEVEL IN THE BLOOD SERUM DURING INSULIN HYPOGLYCEMIA AND AFTER METRAZOL CONVULSIONS: G. Heilbrunn, E. Liebert, Endocrinology, vol. 25, No. 3, Sept., '39, p. 354.

The amount of vaso-constrictor substance present in the blood of these patients was determined at intervals following the injection of insulin or metrazol. Patients could be divided into three types. In the first group, patients went into shock and showed low adrenalin concentrations. The non-shock curves showed a rise in blood adrenalin. In the third group the adrenalin level was dependent upon muscular activity.

THE PERIODICITY OF INFLUENZA: J. H. Webster. Edinburgh Med. Jr., vol. 46, No. 9, Sept., '39, p. 591.

From the records of epidemics the author has devised a two-phase rule for predicting outbreaks with the hope that it would enable prophylactic treatment for the highly susceptible in time to prevent occurrence.

PREPARATION OF UNIVERSALLY COMPATIBLE ASCITIC FLUID FOR TRANSFUSION: R. M. Choisser and E. M. Ramsey. Am. Jr. Clin. Path., vol. 9, No. 5, Sept., '39, p. 545.

By electrodialysis, adjustment of pH and Berkefeld filtration the agglutinins of ascitic fluid were eliminated so that it could be used without cross matching to combat experimental shock in dogs.

VITAMIN K—ITS USE IN HEMORRHAGIC DISEASES: C. D. Bussey. Dallas Med. Jr., vol. 25, No. 8, Aug., '39, p. 97.

Vitamin K is required in the synthesis of Prothrombin. A case is cited in which all hemorrhage was stopped in about 24 hours by use of Vitamin K and bile salts.

BOOK REVIEW

STANDARD METHODS of the Division of Laboratories and Research of the New York State Department of Health, by Augustus B. Wadsworth, M.D., Director. Second Edition. 681 pages, 55 figures and 39 plates, 1939. The Williams and Wilkins Company, Baltimore, Md. Price $7.50.

This second edition of Standard Methods describes the general technical procedures including important new material and the special procedures as used in the various branches of the Division of Laboratories and Research of the New York State Department of Health. Particular mention may be made of the introduction of the new quantitative technic in the complement-fixation tests, the revised colloidal gold test, and of new methods in the production, concentration, and standardization of certain therapeutic sera.

Basically, the laboratory is concerned with the problems of infection and immunity. Investigations of these have been so extended that it has become necessary to organize departments of biochemistry and biophysics since the first edition of this volume. This second edition reflects the great recent advance in public health laboratory services. General technics are described sufficiently for the experienced worker, but the novice and the less experienced technician should become thoroughly familiar with the introductory chapters before following the methods of the diagnostic or the antitoxin, serum and vaccine laboratories.

This work has been widely accepted because it has proved to be practical and dependable in every detail. Here the reader is given the "result of experience in guarding against error."

NEWS AND ANNOUNCEMENTS

REGISTRY OF MEDICAL TECHNOLOGISTS
OF THE
AMERICAN SOCIETY OF CLINICAL PATHOLOGISTS

WARNING

Numerous complaints have reached the Registry of Medical Technologists regarding the activities of a Mr. C. A. Bartholomew of Red Bank, New Jersey, who has launched an organization styled the "American Medical Technologists" which purports to issue certificates of qualification. It is soliciting membership especially among graduates of non-approved schools or those who are ineligible for examination by the standards of the Registry.

Mr. Bartholomew has never taken the Registry examination but assumes the designation of M.T. after his name in his drive for membership. He has also presumed to give approval to a number of commercial schools which are under the disfavor of the Registry.

This enterprise is not sponsored by any scientific society but appears to be motivated by commercial aspects, as a $5.00 registration fee is solicited from those desiring to join.

To obviate any confusion of this unauthorized movement with the legitimate work of the Registry of Medical Technologists of the American Society of Clinical Pathologists, this warning is issued to all interested in maintaining high standards to disseminate the true information to the unwary about the standing of the so-called "American Medical Technologists".

Four hundred and twenty-two new registered Medical Technologists were added to the roster of the Registry of Medical Technologists of the American Society of Clinical Pathologists as of January 1, 1940, having been successful in the regular semi-

annual examination which was held in October, 1939.

The following questions were used in the written section of the examination:

WRITTEN QUESTIONS FOR EXAMINATION OCT., 1939
(Maximum Time for Written Examination—3 hours)

IMPORTANT—Select 10 out of 11—DO NOT answer more than 10 questions.

I. Give the normal values of the following in blood:
   1. Bleeding time in minutes
   2. Hemoglobin in 100 cc.
   3. Platelets per c.mm.
   4. Uric acid in 100 cc.
   5. Cholesterol in 100 cc.
   6. Calcium (serum) in 100 cc.
   7. Sugar in 100 cc.
   8. Non-Protein Nitrogen in 100 cc.
   9. Protein, total (plasma) in 100 cc.
   10. Urea nitrogen in 100 cc.

II. 1. Give the normal values of the following in cerebrospinal fluid:
   1. Cells per c.mm.
   2. Sugar in 100 cc.

2. Describe the technic of setting up Lange's Colloidal Gold Test.

III. 1. What laboratory procedures are available for the diagnosis of typhoid fever and when is each most effective?

2. In what pathologic condition is the "heterophile antibody test" of value? List the reagents used.

IV. 1. What characteristics assist in distinguishing an exudate from a transudate?

2. List the reagents used in one of the standard tests for detection of occult blood in feces.

V. 1. Give a method and list the reagents used in detecting each of the following in urine:
   1. Bence-Jones protein
   2. Sugar

2. How can amorphous urates be dissolved in urine?

VI. 1. Define:
   1. Polycythemia
   2. Anisocytosis
   3. Megaloblast
   4. Antigen
   5. Basophilic granular degeneration

2. What is the hydrogen ion concentration of water with pH. of 7.0?

VII. 1. List the reagents used in the complement fixation test for syphilis.

2. Give the technic for one of the flocculation tests for syphilis.

VIII. 1. What significance has rouleaux formation in blood compatibility tests?

2. What are the Moss and Jansky Blood Groups corresponding to the International Groups AB and B?

IX. 1. What the the important examinations made on gastric contents?

2. In what determination is Toepfer's reagent used?

X. Give the reaction to Gram's stain and a suitable culture medium for the growth of the following organisms:
   1. Neisseria gonorrhoeae (gonococcus)
   2. Corynebacterium diphtheriae (diphtheria bacillus)
   3. Mycobacterium tuberculosis (tubercle bacillus)
   4. Hemophilus ducreyi (Bacillus of Ducrey)
   5. Brucella abortus

XI. Express the following quantities in milligrams:
   1. 0.110 grams
   2. 0.045 grams
   3. 0.005 grams
   4. 1.500 grams
   5. 0.001 grams

NATIONAL

Scientific and Commercial Exhibits

The committee wishes to report satisfactory progress in obtaining commercial exhibits of apparatus and supplies of special interest

to technologists. The prospect is excellent for a technical exhibit, larger in number of exhibitors and wider in its scope, than at any previous convention.

Society members have been slow in sending in application forms for space for their *scientific* exhibits or those accompanying their papers. It is hoped that by the time this issue of the Journal reaches our members, a considerable number will already have filed applications before the closing date, March first. This is imperative, in order that the committee may arrange for your exhibit needs.

ANNETTE M. CALLAN, *Chairman*,
Southern Pines, North Carolina.

The selection of Sub-Counsellors, one for each state, is being completed. These members will help their district counsellors with membership and state affiliation activities.

Counsellors and Sub-Counsellors of the A. S. M. T.

New England States, Mr. John Fitzgerald, Portland, Maine.

Sub-Counsellors: Miss Marion Alcott, Boston, Mass.; Miss Olive Gray, Dover, New Hampshire; Miss Emma Shevsky, Hartford, Conn.

Unassigned: Maine, Vermont, Rhode Island.

Mid-Atlantic States, Mrs. Doris Griffiths, Utica, New York.

Sub-Counsellors: Miss Mary Cooper, Syracuse, New York; Miss Phyllis Stanley, Newark, New Jersey; Miss Dorothea Zoll, Philadelphia, Pa.; Mr. Edward Walker, Baltimore, Md.

Unassigned: Delaware, District of Columbia.

South Eastern States, Miss Elizabeth Cramer, Lexington, Ky.

Sub-Counsellors: Miss Jean Rankin, Parkersburg, W. Va.; Miss Ida Reilly, Hampton, Va.; Miss Mary Leisman, Louisville, Ky.; Miss Louise Feemster, Memphis, Tenn.

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East Central States, Sister M. Faustine Masanz, Fond du Lac,

Wis.

Sub-Counsellors: Miss Emma Wehrle, Marion, Ohio; Miss Gladys Jacobs, Bay City, Mich.; Miss Rachel Lehman, Indianapolis, Ind.

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Sub-Counsellors: Miss Rose Matthaei, Houston, Texas; Miss Clara Becton, Tulsa, Okla.; Mr. James Reynolds, Roswell, New Mexico; Sister M. Jeannette Bodoh, Hays, Kansas; Miss Catherine Smith, St. Louis, Mo.; Mrs. Margaret Clark, North Little Rock, Ark.

Unassigned: Louisiana.

West Central States, Mrs. Gertrude Hughes, Madison, Nebr.

Sub-Counsellors: Miss Dorothy Ashland, Fargo, No. Dak.; Mr. Harry Falconer, Sioux Falls, So. Dak:; Miss Mildreda Sheldon, Omaha, Nebr.; Miss Irene Carlson, Des Moines, Ia.; Miss Olga Nelson, St. Paul, Minn.

North Western States, Miss Mae Spoonar, Everett, Wash.

Sub-Counsellors: Miss Katherine Stewart, Seattle, Wash.; Miss Patricia Berry, Portland, Ore.; Mr. Justin Wood, Sheridan, Wyo.

Unassigned: Montana, Idaho.

South Western States, Miss Marie Hess, San Francisco, Cal.

Sub-Counsellors: Mr. Herman Pryon, Fresno, Cal.; Miss Margaret Morse, Denver, Colo.

Unassigned: Arizona, Utah, Nevada.

Because of inquiries concerning state affiliation and selection of members of the House of Delegates, the following paragraphs from the Articles of Incorporation and By-Laws are being republished:

Article XI. Affiliated and Subordinate Societies

Section 1. Any society of medical technologists, whose active membership is composed of persons who abide by the code of ethics of the American Society of Medical Technologists, may become affiliated with this society and maintain such affiliation upon complying with the by-laws of this society. Members of an affiliated society shall not by such affiliation become active members of this society.

Article II. Affiliated Societies

Section 1. A state society of medical technologists desiring to affiliate with this society shall apply for affiliation on a form authorized by this society, accompanied by a charter fee of five dollars ($5.00), a list of names and addresses of its officers and members (indicating thereon those who are members of this society) and its constitution and by-laws, if unincorporated, or its articles of incorporation and by-laws, if incorporated. Such application shall be submitted to the executive secretary, and by him to the member of the board of counsellors appointed for the district of the society desiring to affiliate, who shall investigate the eligibility of the society for affiliation. A report of this investigation and the application shall be sent to the advisory board, which shall be the judge of the eligibility of such society for affiliation as provided in the articles of incorporation.

Section 2. The purposes of such society, as expressed in its constitution or articles, shall not be contrary to the purposes of this society and one of its expressed purposes may be to promote the growth and welfare of this society. The advisory board shall also satisfy itself that granting an application for affiliation will not be inimical to the purposes or progress of this society. All changes in the rules, laws and organization of such affiliated society shall be reported to the executive secretary. All amendments to articles of incorporation and constitutions of affiliated societies shall comply with the provisions of this section applicable to original articles of incorporation and constitutions.

Article X. Government

Section 2. The House of Delegates shall be composed of the president, president-elect, recording secretary, treasurer, executive secretary, board of directors and advisory board then in office, and of delegates from affiliated or subordinate societies and of delegates from members in states not having affiliated or subordinate societies apportioned and chosen as provided by the by-laws, and of such other persons as may be authorized by the by-laws.

Article III. House of Delegates

Section 1. Each affiliated society in good standing shall be entitled to one delegate in the House of Delegates for every twenty-five

(25) members of such society who are at the time of the meeting of the House of Delegates active members in good standing in the American Society of Medical Technologists, except that each affiliated society shall be entitled to at least one and not more than six delegates. The affiliated society shall provide the method of electing or appointing its delegates.

Section 2. The active members of the society residing in a state which does not have an affiliated society shall be entitled to one delegate in the House of Delegates to be designated in writing signed by a majority of such members, or in the absence of such designation, to be elected by a majority of active members in good standing from said state present at the annual meeting of the society.

Section 3. Members of the House of Delegates shall vote in person and not by proxy, but in the absence of a delegate, an alternate may serve in place of such delegate. In the absence of a rule of an affiliated society prohibiting it, the president of an affiliated society shall have the power to appoint alternate delegates.

Minnesota

FACTS YOU SHOULD KNOW

1. The Minnesota Society of Medical Technologists was organized in the year of 1937, and held its first meeting in Rochester in May, 1937, where it elected its first officers and accepted the Constitution prepared by a Constitution Committee made up of Duluth Technologists.

2. The second annual meeting was held in Minneapolis, the third in St. Paul, and the next convention will again be held in Minneapolis. The time and place for these meetings are determined by the Minnesota Hospital Association with whom we have the honor of sharing the privileges of their own Annual Meeting. Further notices of the next meeting will be given in April issue of this paper.

3. Last year the first issue of "Minnesota Medical Technologist" was printed and sent to all Registered Technicians in the State of Minnesota. This year there will be four numbers in all, and we have progressed from the "mimeographed" to the "printed" paper, which we feel is a real step forward. The increased cost of this

step, however, makes it necessary to cut down the number of copies and these will now be sent only to those of you who have paid your dues to the Minnesota Society.

4. Through the efforts of your Constitution Committee, the Minnesota Society of Medical Technologists has now become duly incorporated in the State of Minnesota. Another big step forward.

5. Steps are now being taken to prepare the required papers for becoming affiliated with the *American Society of Medical Technologists*. This will mean that our state will have representation in the "House of Delegates" of the National Society, in time for the convention of that society in New York next June.

6. We have received copies of the Florida state paper, "The Scope," and the California state paper, "The Filter," from the editors of these papers, who are interested in establishing an exchange with us. Therefore there has been appointed to our editorial staff, an "Exchange Editor" or Librarian, whose duties it will be to carry on an exchange with editors of other states, who will keep these other publications on file for all who may be interested in seeing them, and who will exhibit them at the annual meeting in May.

7. Your Board of Directors has held three meetings so far this year to keep the business of the Society moving along. The Chairmen of the Standing Committees have attended these meetings to report their progress, and various plans regarding the printing of the paper, the stimulation of interest in the Society, and ideas for the Convention in May, have been discussed.

8. Acting upon the suggestion of the Board of Registry in Denver, the President of the *American Society of Medical Technologists* has appointed a committee to meet with the Board of Registry at their Annual Meeting in June and to discuss any problems which the Technologists feel they would like to discuss with the Pathologists on the Board. Your Minnesota President is a member of this committee and will be glad to carry your problems to the Board of Registry.

We congratulate the Staff of THE MINNESOTA TECHNOLOGIST, *official publication of the Minnesota Society of Medical Technologists, Inc., on the presentation of their new quarterly from which the above items are reprinted (January, 1940, issue)*—EDITOR.

Pennsylvania

Technicians' Institute held under the auspices of Temple University School of Medicine, Broad and Ontario Streets, Philadelphia, Pa., March 11, 12 and 13, 1940.

FOREWORD

Believing that medical technologists require and will appreciate an opportunity for frequent post-graduate study, with special reference to the technic and practical applications of newer laboratory methods, Temple University School of Medicine, with the cooperation of various other Philadelphia institutions, is hereby offering a second Technicians Institute to serve this purpose since the first, given in April, 1938, was so successful that numerous requests have been received for another.

COMMITTEES

Director—John A. Kolmer, M.D.

Program Committee—John A. Kolmer, M.D., Chairman; Fred Boerner, V.M.D.; Carl Bucher, M.D.; Helen Ingleby, M.D.; Samuel W. Sappington, M.D.; Lawrence W. Smith, M.D.

Committee of Arrangements—Edwin S. Gault, M.D., Chairman; Miss Catherine M. Clarkson, Mrs. Kathleen E. Cornell, Miss May Eichman, Miss Marion Gianniny, Miss Mary Howard, Miss Louise C. Miller, Miss Dorothea Zoll.

NOTICE—MEDICAL TECHNOLOGISTS

At the request of the Surgeon General of the Army and in compliance with its policy of cooperation with both the Army and Navy, the American Red Cross, as an expansion of its peace-time service for the military forces, has undertaken the enrollment of various types of medical technologists who are willing to serve in the medical departments of the Army and Navy if and when their services are required at the time of a national emergency.

Persons with the following qualifications will be enrolled:

Chemical Laboratory Technicians (male)
Dental Hygienists (male and female)
Dental Mechanics (male)
Dietitians (male and female)
Laboratory Technicians (male and female)
Meat and Dairy Hygienists (Inspectors) (male)
*Nurses (male)
Occupational Therapy Aides (male and female)
Orthopedic Mechanics (male)
Pharmacists (male and female)
Physical Therapy Technicians (Aides) (male and female)
Statistical Clerks (male and female)
X-Ray Technicians (male and female)

General qualifications for enrollment are as follows:

1. Citizens of the United States.
2. Ages 21-45 years (Army); 18-35 (Navy—*men only*)
3. Physically qualified. Applicants must pass a satisfactory physical examination, according to standards set respectively by the Army and Navy Medical Departments.

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*This group will not be members of the Army or Navy Nurse Corps which under basic law are limited to females, but will be used as technologists for service auxiliary thereto.

4. Women applicants must be unmarried.
5. All applicants must express a willingness to serve as a technologist in time of a national emergency.

Male technologists will be eligible for enlistment in the Army as non-commissioned officers in the grades of sergeant, staff sergeant, or technical sergeant. Women technologists, and men who do not qualify physically, will be eligible for employment by the Army as civilians.

For the Navy, male technologists will be eligible for enlistment in the Naval Reserve as Petty Officers—Pharmacist's Mates 3d, 2nd, and 1st, Class and Chief Pharmacist's Mate (acting appointment). Women technologists are not eligible for service in the Navy under present plans.

The Medical Department of the Army will require a considerable number of technologists in each of the above named groups. The Navy Medical Department requirements will be similar except for dietitians, occupational therapy aides, orthopedic mechanics and dairy and food hygienists (inspectors) who will not be needed. Notwithstanding the maintenance of this enrollment, the Navy also desires peace-time enlistment in the U. S. Naval Reserve, and male technologists who wish to enlist in the Naval Reserve are urged to communicate direct with the Commandant of the Naval District in which they reside. The address of their Commandant will be furnished upon request.

Technologists who qualify according to these general standards and who are willing to enroll for service as outlined above should communicate with The American National Red Cross, Washington, D. C.

NEW YORK'S WORLD'S FAIR FOR 1940 ADDS INTEREST TO CONVENTION CITY

Scores of new features are announced by the New York World's Fair for its 1940 season opening May 11.

The most outstanding attractions of last year will naturally be retained and improved. Because of war conditions abroad, the international area—high spot of 1939—will give the globe-trotting minded a chance to circle the world in 80 minutes without dodging submarines. Russia is the only great nation withdrawing her exhibit. Others have signified their intention of returning or already have signed renewal contracts. Even Finland, despite her life and death struggle, is reopening her pavilion, and those of Poland and Czecho-Slovakia are to be operated by private subscription it is expected.

Late last year a movement was started to accent all things South American at the 1940 Fair. It now seems certain that international solidarity in this hemisphere will be stressed by participation of the Latin-American nations. In dramatic contrast to events that have resulted in putting gas masks on babies abroad, the great exposition this year becomes a patriotic excursion in democracy —a living lesson in American ideas and ideals.

Federal and State exhibits are expected to loom larger this year in view of the increased interest in America's shrines and show places. The U. S. government will again occupy its imposing structure at the head of the Court of Peace, dominating the area on which are assembled the displays of sixty foreign nations. This great edifice, with its two massive towers flanking a colonnade of thirteen columns—one for each of the original states—contains exhibits depicting the functions of government in every field. To give the average citizen a better idea of the services for which he is taxed, twelve basic sections show him Uncle Sam's activities in

conservation, food, shelter, industry, trade, finance and credit, transportation and communication, social welfare, education, arts and recreation, national defense, foreign relations, territorial possessions, and fiscal affairs. The dominant feature of each exhibit is a revolving mural seven feet wide and extending twenty-three feet up the wall of the building. Painted by Eugene Savage on canvas "belts," these murals revolve slowly downward into groups of statuary. The nation's traditions and achievements are also pictorialized in a special motion picture shown in a theater seating 500 persons. Regardless of his politics, the visitor cannot fail to be impressed with the essentially human services of American democracy.

Heightened interest in the State exhibits this year is due in part to the "See America" tourist campaigns while travel to Europe is restricted. Already twenty-one states and the territory of Puerto Rico are expected to re-open their exhibits. As rental charges for space in Fair-owned buildings has been cut in half for 1940, several states not present last year are expected to participate. The first renewal contract executed by a state was that of Florida, which occupies the largest area of any state, on the banks of Fountain Lake.

As great a drawing card as the government exhibits last year were the industrial displays, and it is a striking commentary on the success of the Fair from the exhibitors standpoint that on November 13, 1939, executives representing $20,000,000,000 (B) of capital investment signed contracts for spaces in 1940. At that time Mr. Harvey D. Gibson, Chairman of the Board of Directors of the Fair, announced that all 1939 exhibitors occupying their own buildings were expected to renew their contracts—a prediction which is rapidly being borne out. As of January first, a partial list of these renewals includes General Electric, Johns-Manville, American Telephone and Telegraph, Du Pont, the Railroads Exhibit, the Petroleum Industry Exhibit, Beech-Nut, Continental Baking, International Business Machines, Metropolitan Life Insurance Co., Yale and Towne Manufacturing Co., the Glass Industry Exhibit, National Dairy, Elgin, Distilled Spirits, General Motors, Chrysler, Ford, U. S. Aviation, Consolidated Edison, Carrier Corp., Coty, Inc., General Cigar, the Bayer Co., Electric Utilities, which includes the Electrified Farm, the Anthracite Industry, the Y. M. C. A., the Equitable Life

Insurance Co., Borden's, American Tobacco Co., United States Steel, Household Finance Corp., Otis Elevator, Westinghouse and Standard Brands.

A complete "change of show" will be staged in many of these exhibits—even the General Motors Exhibit, which was one of the most popular features of the entire 1939 Fair is being revamped. At the same time, visitors to the new Fair will see again the industrial attractions that proved outstanding in 1939—the discharge of ten-million volts of lightning under the careful control of expert engineers, a trip through the World of 1960, tires made from raw material to finished product in four minutes, ramp-riding automobiles, living germs magnified to the size of cats and wiped out by an amazing scientific device, and the modern miracle of television with all the improvements attained in recent months.

The keynote of the industrial displays, as of the Fair itself, was struck by Mr. Henry Ford at the signing of the Ford contract for 1940 when he said:

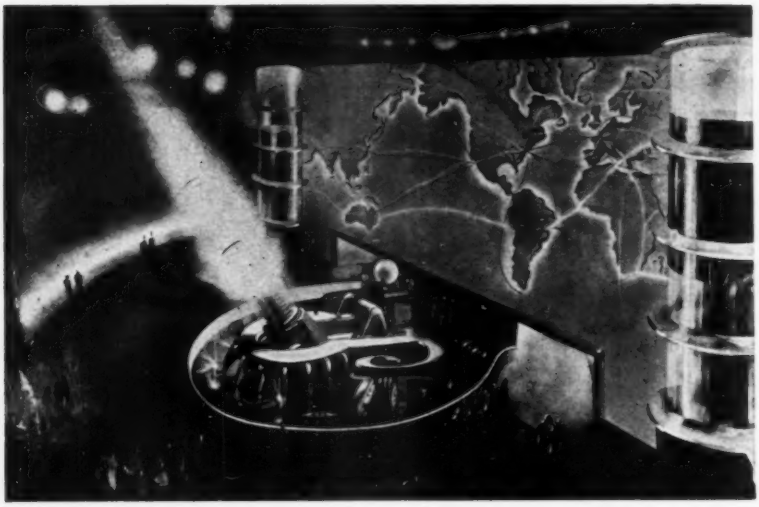
"There will be one place next spring where the nations of the world will meet in peace, and that's the New York World's Fair. That is one reason why we will be there. Another reason is my interest in the education of young people. They are our opportunity and hope for the future—they justify all the effort and expense of these fairs. The Fair will be a demonstration of what life in this world might be if wars were banished and the energies of men were devoted to the arts and crafts that build a better world."

It will indeed be a far cry from foreign wars to the great exposition of 1940, where democracy and industry will parade in a setting of unequalled beauty and where the spirit of friendship and fun will reign supreme. The Fair's management, its exhibitors, and the five million people of New York City who will be hosts to Fairgoers are bent on continuing this year the policies inaugurated late last season which attracted the gigantic crowds of October. In announcing the low admission rates, Mr. Gibson declared that "there will be more free fun and entertainment than at any time last year," and added:

"Hotels, transportation lines and concessionaires generally have one thought in mind, and that is to correct the impression of high prices which unfortunately prevailed last year. They will do this by definitely agreeing to and establishing fixed and reasonable low rates

LAGOON OF NATIONS, N. Y. WORLD'S FAIR, 1940

for 1940." Equally important, perhaps, is the remark of one Fair official that "the high hat has been tucked away in mothballs, and the show is as warm and friendly as the old-fashioned county fairs that we used to have up in Vermont when I was a kid." More than fifteen hundred free exhibits will be on view next season. The free dances to great name bands, the marvelous fireworks displays, the dazzling Magic Fountain and similar spectacles will be repeated, and there will be spacious grounds where families can picnic under



A ROCKET SHIP AT THE NEW YORK WORLD'S FAIR

gaily-striped umbrellas or in the shade of beautiful trees. A completely new Amusement Area, with one of the most novel and effective lighting schemes ever devised, will greet visitors in 1940. Outstanding hits of last season such as Billy Rose's famous Aquacade will be back, in even more spectacular form. Among them are Frank Buck's Jungleland, a Michael Todd production in the Music Hall replacing his "Hot Mikado" of last year, and a rejuvenated parachute jump which in 1939 hauled more than 555,000 thrill seekers 250 feet in the air and dropped them like plummets under eleven vividly colored parachutes from its top. And everywhere, the bril-

liant landscaping, with its 10,000 trees and its 2,000,000 shrubs and flowers which made the 1939 Fair a riot of color, is being carefully preserved throughout the winter to dazzle anew the eyes of visitors next season.

Twenty-six million men, women and children—nearly one out of every five in the United States—paid their way into the 1939 Fair. Yet it seems that this figure will be greatly exceeded in 1940. The reasons are not merely war conditions abroad, or the desire of Americans to view the marvels of the world's greatest exposition against the background of the world's greatest city. Equally important is the atmosphere of "neighborliness" which pervaded the closing months of the exposition last year, and which will be even warmer in 1940. America will be at home at the new Fair, from the opening on May 11th to the close in late October. Americans by the millions will again make it a major objective this summer in their travel plans.

Cuts supplied through courtesy of Convention and Visitors Bureau.

DO NOT DELAY THE RENEWAL OF

YOUR CERTIFICATE FOR 1940 in the

REGISTRY OF MEDICAL TECHNOLOGISTS

234 Metropolitan Building
Denver, Colorado

Mrs. Anna R. Scott, Registrar